ISS Utilization Management
Concept Development Team

Briefing to:

NASA Center Directors

September 12-13, 2002

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Meeting Objectives & Introduction

- Which functions are most suitable for consideration for an NGO?
- Which options appear to be most feasible to implement?
- Is anything missing from the proposed evaluation criteria? Which elements of the criteria are most critical?
- Should other change activities contemplated within the Agency impact the approach to be taken or the timing of implementation?
- Given these considerations, what focused recommendation can we provide to the Enterprise Council and the Administrator?

Background

Agency Activities to Date

Numerous Agency studies have been performed addressing many organizational structures and implementation options for ISS research utilization management, including:

- October 1999 - Options for Managing Space Station Utilization, Swales Aerospace
- December 1999 - Institutional Arrangements for Space Station Research, National Research Council
- August 2000 - International Space Station Operations Architecture Study, Computer Sciences Corporation
- June 2001 - NASA Internal Study
- February 2002 - International Space Station Payload Operations Concept and Architecture Assessment Study (POCAAS), Computer Sciences Corporation

Congressional and White House Direction

Congressional Direction on Management of ISS Research:

- The FY 2000-NASA Authorization Act (P.L. 106-391) calls upon NASA to enter into agreement with an Non-Government Organization (NGO) for the management of ISS research, and submittal of an implementation plan by September 2001; the NGO agreement may not take effect until 120 days after submission of the implementation plan

- The FY 2001 and FY 2002 VA-HUD-IA Appropriations Acts seek a "comprehensive proposal for managing the ISS science program," prior to establishment of any NGO

White House Direction on Management of ISS Research:

- The March 2001 White House "Blueprint for a New Beginning," included guidance to NASA to: "open future Station hardware and service procurements to innovation and cost-saving ideas through competition...including a NGO for Space Station research."

Blue Team Charter

The ISS Utilization Management Concept Development Team was established in March 2002 to examine detailed options for management of ISS research

Team Charter:

- Characterize the current Agency ISS utilization processes, organizational interfaces and management framework
- Identify inherently governmental functions within the ISS utilization processes
- Assess the advantages and disadvantages of various management approaches to ISS utilization
- Recommend NASA process and/or organization changes/reforms
- Identify implications for workforce transition and/or skill mix rebalancing

Team Membership

Mark Uhran/HQ

Barbara Kreykenbohm/HQ

Eve Lyon/HQ

David Beck/HQ

Karen Blynn/GSFC/HQ

Bonnie Dalton/ARC

Jack Salzman/GRC

Angel Otero/GRC

Betsy Park/GSFC

Jennifer Rhatigan, PhD/JSC

Jim Scheib/JSC

Michael Richardson/JSC

Mary Hall/KSC

Roselle Hanson/KSC

William Cirillo/LaRC

Robin Henderson/MSFC

Thomas Inman/MSFC

Red Team Status

- Red Teams were organized to provide check and balance to the ISS Utilization Management Concept Development Team process
- Red Team I assessments were held June 10 - 12 and August 12 – 13; **Charter:**
  - Review Team process, products, schedule and forward action plan for technical accuracy, completeness, and viability.
  - Informally review Red Team I findings with the Team and provide guidance on process, products, schedule and forward action plan.
  - Document (written) and present (oral) findings and recommendations to the OBPR Associate Administrator.

- Red Team II assessment was held August 13 – 15; **Charter:**
  - Review model outcomes and associated Agency civil service and contractor workforce, core competency and facility implications.
  - Informally review Red Team II findings with the Blue Team and provide guidance as appropriate.
  - Document (written) and present (oral) findings and recommendations to the OBPR Associate Administrator.

- The Red Teams' guidance contributed constructively to the process and products

Red Team Members

Red Team I – John Campbell, PhD, Chair

ARC / Scott Hubbard, PhD

GRC / Steve Simons

JSC/ Bill Gerstenmaier, Charles Stegemoeller

KSC/ Maynette Smith, Randy Galloway

LaRC/ Roger Breckenridge, PhD

MSFC/ Jan Davis, PhD, William R. Hicks

SSC / Mark Mick

HQ - H / Harold Jefferson

HQ - M / Donna Shortz

HQ - B / Scott Black

HQ - S&Y / GSFC/ John Campbell, PhD
Dave Leckrone, PhD

HQ - U / Eugene Trinh, PhD,
David Tomko, PhD

Red Team II -- Jerry Simpson, Chair

ARC / Scott Hubbard, PhD

GRC / Rudolph Saldana, Kathy Schubert

JSC/ Mike Suffredini, Charles Stegemoeller

KSC/ Josie Burnett, Rita Willcoxon

LaRC/ Roger Breckenridge, PhD

MSFC/ Susan Cloud, Peter Allen,
Tom Stinson, Kim Whitson

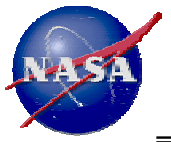
HQ - S/Y / GSFC / Jerry Simpson

HQ - F / Carolyn Davis

HQ - G / Robert Stephens

HQ - H / Harold Nelson

HQ - U / Ray Sparnon



Context

Recurring Inputs from the ISS User Community - (Positive)

- **Research on ISS is a reality and producing results:**
  - The real benefits of long duration experiment operations only available on ISS have been demonstrated
  - Results have been obtained which would not have been possible on Shuttle/ Spacelab; “new and unexpected discoveries have significantly advanced our understanding”
  - Experiments have worked well and achieved their mission success criteria
  - PI research is generally a good experience
  - “Science peer review is going well, an A for this”
- **While new and evolving, the ISS utilization processes are well documented and improving:**
  - Payload processing requirements and safety are well substantiated
  - Analytical integration appears to be transparent to the user, “so it works”
  - The direction that the program has taken shows that the Agency is moving forward
  - Responsiveness is the major strength of the Program
  - “An honest effort is being made to reduce cost and time in the ISS process”
  - The process is flexible enough to accommodate late manifested payloads
- **The ISS Utilization Team is dedicated to the success of ISS research:**
  - “Overall, XXX was a resounding success” and “XXX was successful only because of the dedication and hard work of all the participants”
  - Payload operations organization has performed admirably during the first year of ISS research,
  - “Support from the overall mission ops team was outstanding”
  - Crew has been very accommodating for troubleshooting and added tasks
  - EPIM’s (EXPRESS Payload Integration Manager) have been very helpful, “worked extremely hard” and “willing to work outside their scope”
  - “’….’s’” organization has performed incredibly well, maintaining the basic set of testing criteria while streamlining the process”
  - “’….’ did a great job in producing a very complex piece of experiment hardware and effectively shielded me from all the ISS bureaucracy”

Recurring Inputs from the ISS User Community - (Negative)

- **Lack of commitment to ISS as a World-Class International research facility**
  - Inconsistent and poorly articulated vision, mission and strategy for research on ISS
  - Insufficient science leadership and accountability to users regarding decisions, priorities, and processes
  - Poor alignment of research prioritization with Agency needs and with possibilities for significant successes
  - Reductions in funding, on-orbit research capabilities, and flight opportunities
  - Manifesting/flight planning “seemingly arbitrary” and not controlled by research advocates
- **Burdensome and inefficient systems and processes**
  - Multiple flight justification and approval cycles
  - Rigid requirements, excessive documentation, redundant data requests, unrealistic scheduling templates, varying interpretations of requirements/documentation by reviewers
  - Lack of standardization, nonresponsiveness to user inputs
  - Inability to make adjustments and/or experiment modifications during flight
  - Lost opportunities for multiple experiments in a single mission/increment
- **Cumbersome and daunting organizational structure**
  - Too many layers of management, overlapping and poorly defined lines of authority and responsibilities
  - Lack of communication between organizations
  - “Too many people” with multiple points of contact, interfaces, and handoffs
- **Time from selection to flight is excessive and not consistent with user needs**
  - Selection and approval process too long
  - Hardware development, integration, and training cycle times too long
  - Inadequate use of available hardware for multiple experiments
- **Spacelab requirements, processes, and templates were more user friendly.**
- **Advocacy and outreach are “horribly lacking.”**

Recommended ISS Utilization Management Organization Objectives

1. Facilitate the pursuit of flight research
   - Ensure safety of human life and protection of assets
   - Advocate academic, government, and industry utilization of the ISS
   - Manage efficient research infrastructure and processes in accordance with Agency goals
   - Manage outfitting of the U.S. portion of ISS to enable research
   - Manage research selection and effectiveness

2. Optimize research opportunities within current capabilities of ISS and with future enhancements for greater capabilities
   - Make the complex operating environment associated with ISS transparent to the end-user
   - Reduce the end-to-end cycle time associated with the announcement, selection, development, flight and achievement of results for research and development endeavors on the ISS

3. Increase the long-range productivity of science, technology, and commercial research and development
   - Fully engage the user community across the globe in the the utilization of this world class international laboratory
   - Generate and disseminate:
     - New knowledge
     - Space-based and Earth-based applications

ISS Utilization Functions (Total Scope)

Function 0.	Defining and Implementing Policy and Strategic Plans
Function 1.	Management of Research Utilization
Function 2.	Preparing and Allocating Budgets
Function 3.	Selecting and Prioritizing Research
Function 4.	Establishing Payload/Experiment Requirements and Feasibility
Function 5.	Developing Cost, Schedule and Risk Assessments
Function 6.	Developing and Qualifying Flight Research Systems
Function 7.	Maintaining and Sustaining Flight Research Systems
Function 8.	Developing Ground Systems
Function 9.	Maintaining and Sustaining Ground Systems
Function 10.	Constructing Ground Facilities
Function 11.	Maintaining Ground Facilities
Function 12.	Certifying Safety of Research Flight and Ground Systems
Function 13.	Managing Missions and Allocating Services
Function 14.	Integrating User Missions - Analytical
Function 15.	Integrating User Missions - Physical
Function 16.	Integrating User Missions - Operational
Function 17.	Conducting Research & Analysis and Disseminating Results
Function 18.	Educating and Reaching Out to the Public (including industry)
Function 19.	Recommending ISS Pre-Planned Product Improvements
Function 20.	Managing Archival of Research Samples, Data and Results

Utilization Management Baseline

Baseline ISS Utilization Management Organization
Outline

- Definition and Background
- Organization and Interfaces
- Budget, Personnel and Staffing
- Contract Strategy
- Rationale and Continuous Improvements

Baseline ISS Utilization Management Organization
Definition

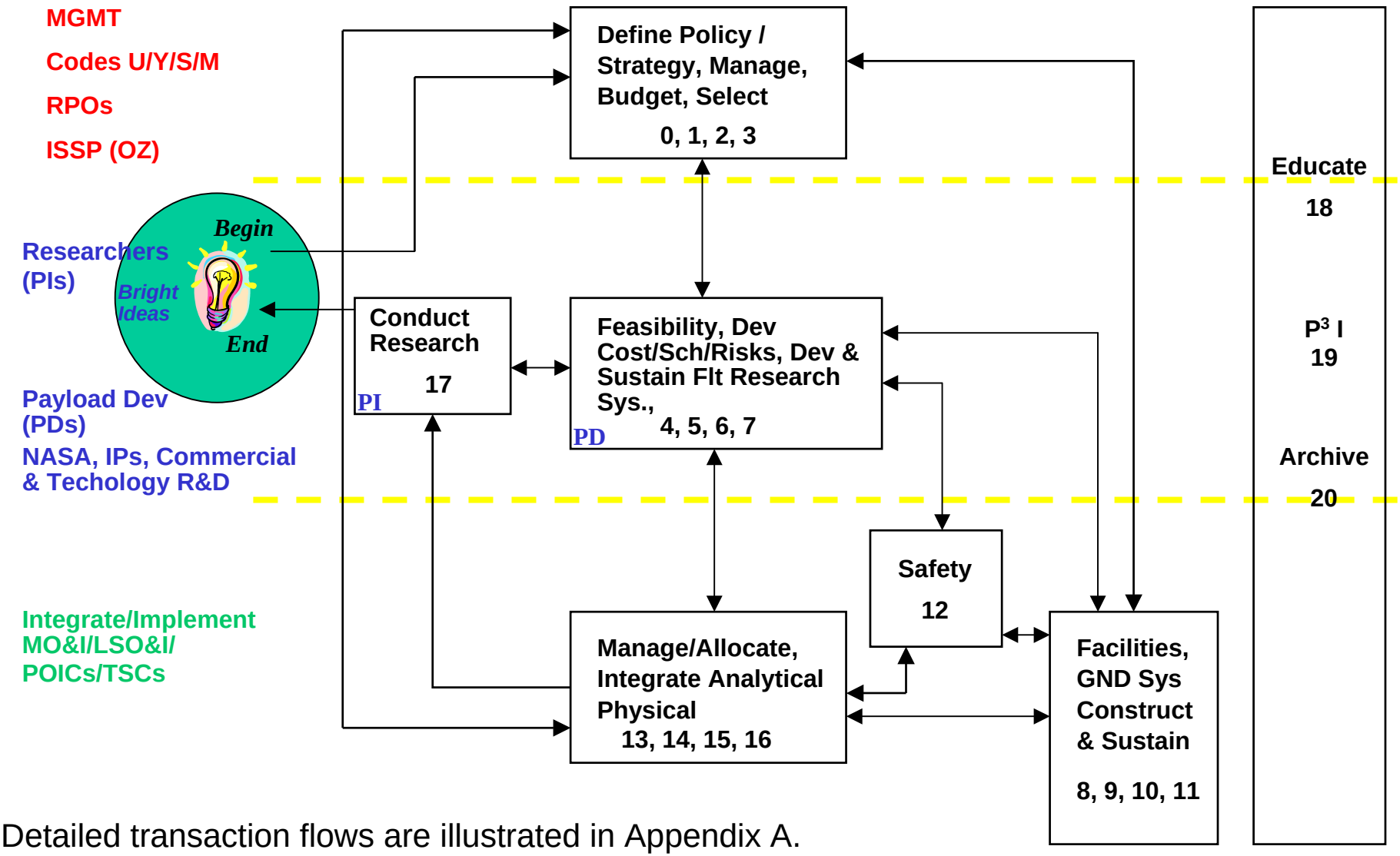
The Baseline International Space Station (ISS) Utilization Management Organization is an element of the NASA government organization. It is dedicated to maintaining the ISS microgravity laboratory in cooperation with our International Partners for science, technology and commercial pursuits. The Baseline encompasses the 21 different functions representing the activities of Utilization Management.

Utilization Management is currently managed by NASA civil service and supported by contractor teams. Improvements include consolidation of contracts and continuous improvement initiatives implemented at various Centers.

Baseline ISS Utilization Management Organization
Description

Utilization Management for the ISS can be further illustrated through a graphic model of the flow of an experiment/ payload onto the International Space Station (Figure A). This flow tracks back to the 21 functions which characterize the current baseline continuous improvement model of Utilization Management.

Baseline ISS Utilization Management Organization
Top Level Flow (Figure A)

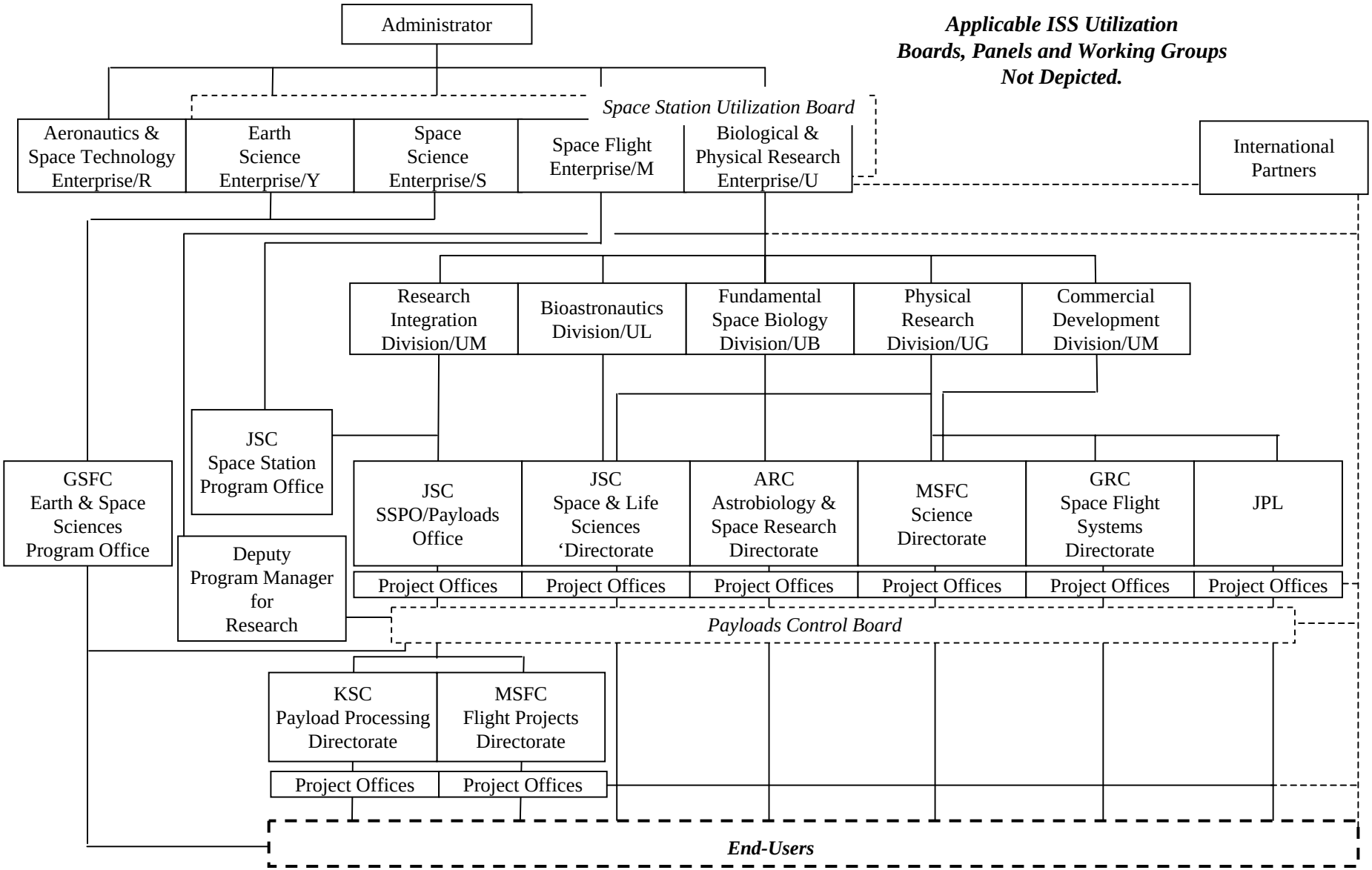


•Detailed transaction flows are illustrated in Appendix A.

Baseline ISS Utilization Management Organization
Management Structure and Interfaces

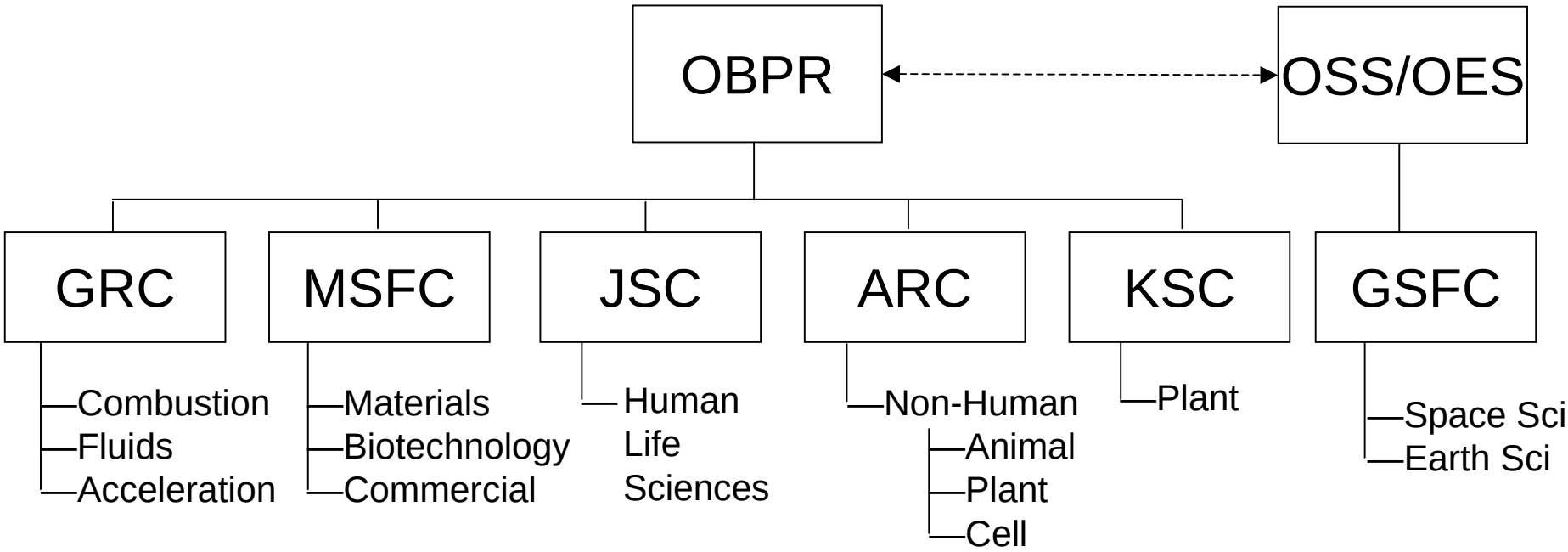
- Figure B illustrates the NASA Management Structure and Interfaces
- Policy, strategic planning, and financial responsibility are within the Office of Biological and Physical Research (OBPR) at HQ
  - Space Station Utilization Board (SSUB) is at HQ and includes representation from all Codes: U, S, Y, M
  - OBPR Program Offices interface to HQ through the Division Offices for funding and discipline specific direction
- Utilization Mission Management of ISS is within the ISS Payloads Office (OZ) is at JSC
  - OZ interfaces to ISS, STS and International Partners
  - Development Centers interface with OZ for integration of payloads
  - Payload Control Board (PCB) at JSC
  - Program Offices interface with OZ for manifesting and resource allocation
- Safety is separate from OZ and HQ and maintained as separate office for both STS and ISS
- Science disciplines associated with the various Centers are shown in Figure C

Baseline ISS Utilization Management Organization (Figure B)



Baseline ISS Utilization Management Organization

Research Enterprises and Discipline Areas (Figure C)



Note: JPL is considered a contractor for the purposes of this activity

Baseline ISS Utilization Management Organization
Process Background

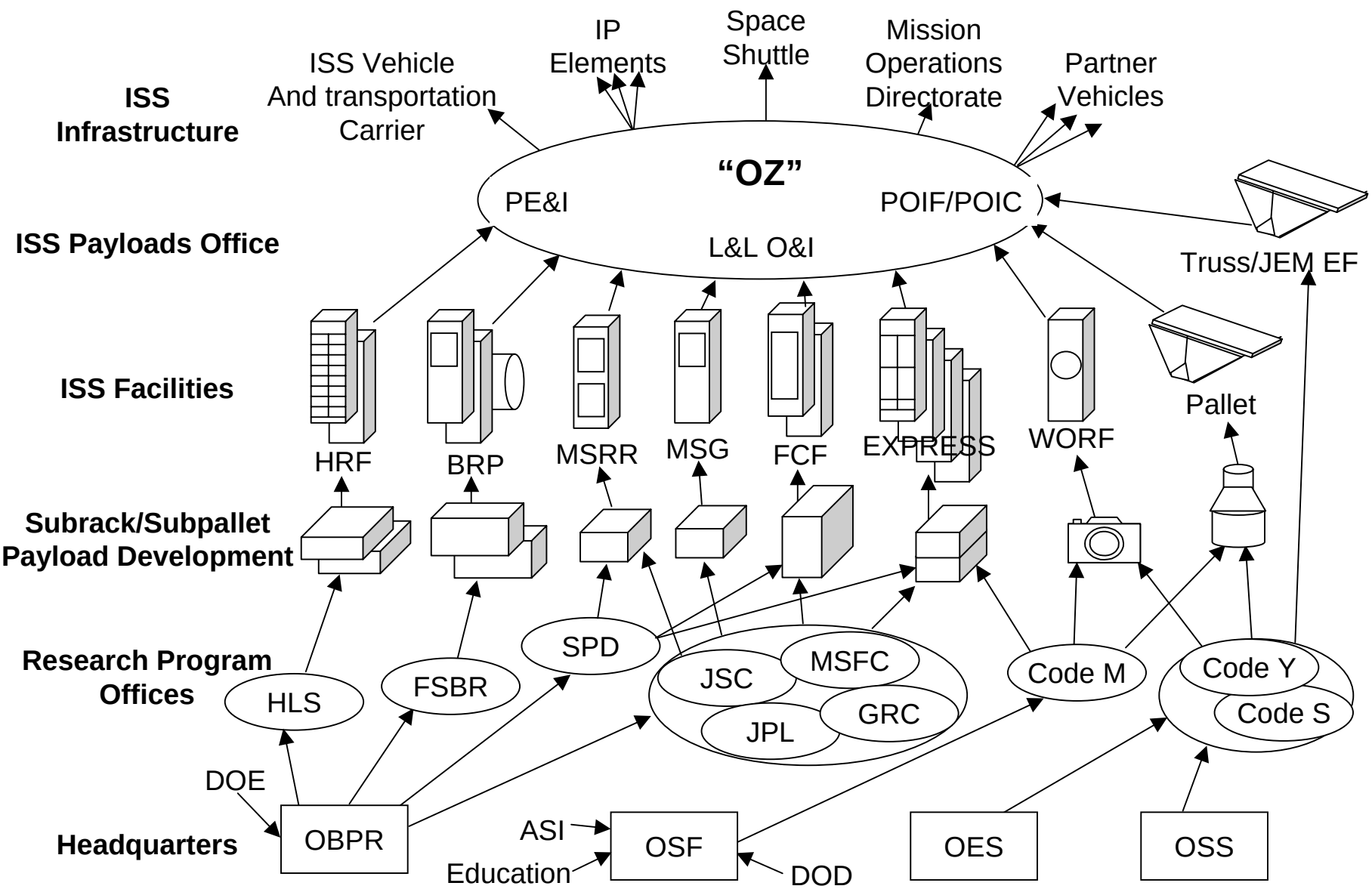
- ISS established an integration process with documentation structure and Payload Developer (PD) support similar to past NASA Programs
  - PIMs are assigned and Integration Agreements and Data Sets are developed
  - Processes incorporate requirements for multiple transfer vehicles, carriers and on-orbit laboratories into one process
- ISS delegates responsibility for development of operations integration products to the PD at the Facility level
- ISS Payloads Office (OZ) is involved throughout the integration process:
  - Defines the integration products
  - Establishes Teams to review and approve the products
  - Provides points of contact to support the PD
- ISS Payloads Office acknowledges the complexity of the Integration process and has processes and teams in place for continuous improvement

Baseline ISS Utilization Management Organization
Technical Process and Interfaces

- Figure D illustrates that the ISS Payload integration process must cover all scenarios associated with ISS for ascent, on-orbit and return
  - Pressurized interfaces and carriers:
    - MPLM Racks
    - US Lab Racks
    - ISIS Drawers
    - Orbiter Middeck
    - Spacehab
    - IP Lab Racks
    - M-01 & M-02 Bags
    - Crew Transfer Bags (CTB)
    - Zero-g Stowage Racks (ZSR)
    - EXPRESS Transportation Rack (ETR)
    - Resupply Stowage Platform (RSP)
    - Resupply Stowage Racks (RSR)
  - Unpressurized interfaces and carriers
    - Truss Attach Sites
    - Orbiter Sidewall
    - Bay 13 Carrier
    - Unpressurized Logistics Carrier (ULC)
    - JEM Exposed Facility
    - EXPRESS Pallet
    - Spacelab Pallet (SLP)
    - Orbiter Bay
    - Spacehab ICC
  - Alternate Launch Vehicles
    - STS
    - Soyuz
    - Progress
    - Ariane Transfer Vehicle (ATV)
    - H2 Transfer Vehicle (HTV)

Baseline ISS Utilization Management Organization

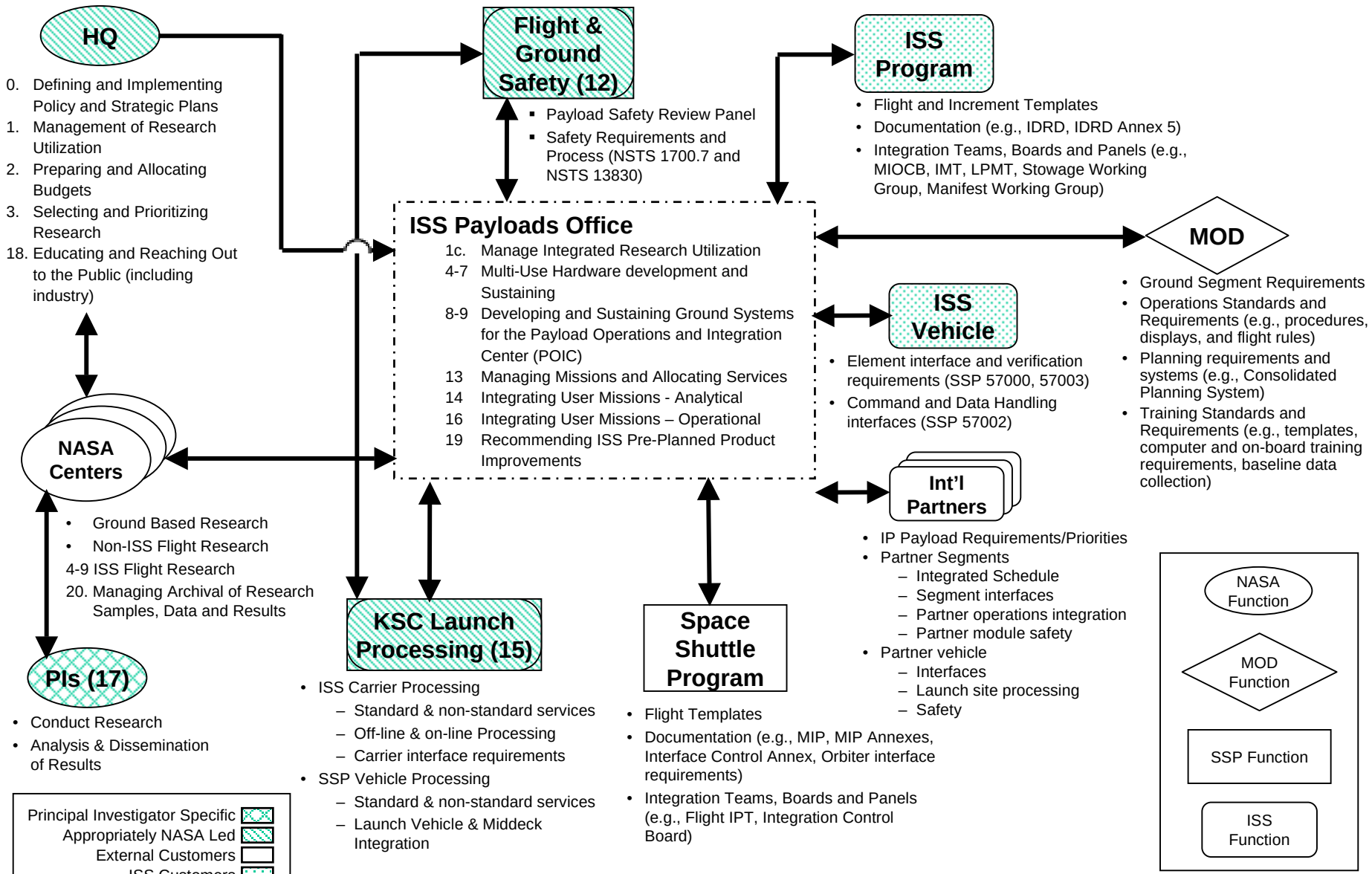
Technical Process and Interfaces (Figure D)



Baseline ISS Utilization Management Organization
Trade Space Considerations

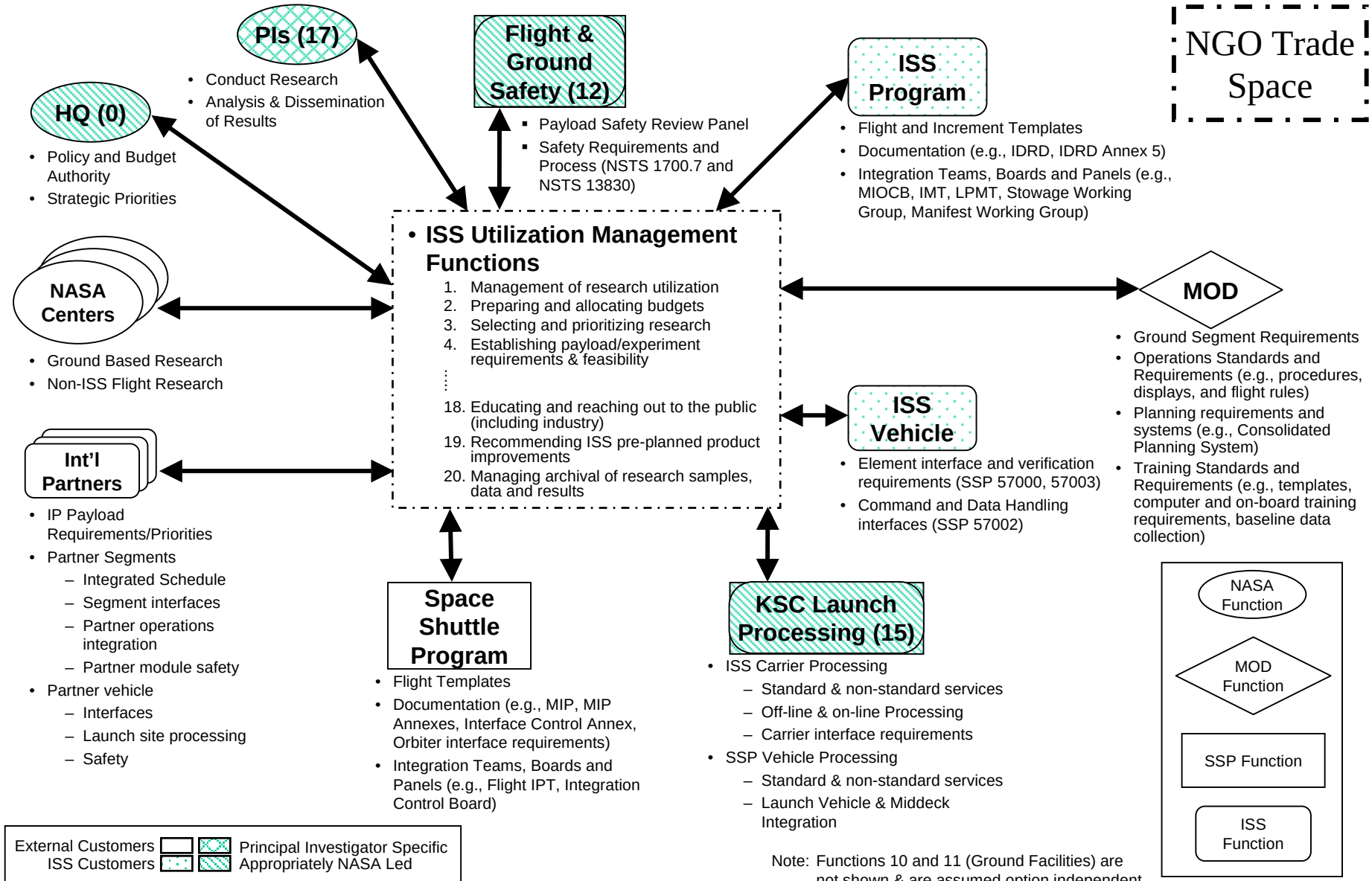
- Figure E illustrates the distribution of the Utilization Management functions across the NASA implementing organizations. It also illustrates the external interfaces that comprise the other elements of the ISS and transportation infrastructure
- Figure F depicts the collected trade space considered by the alternate Utilization Management Organization Options. It also illustrates remaining external interfaces that all Options consider

Baseline ISS Utilization Management Organization
Interfaces (Figure E)



Baseline ISS Utilization Management Organization

Trade Space and Interfaces (Figure F)



Baseline ISS Utilization Management Organization
Budget and Finance

- The budget for ISS Utilization Management is part of the Program Operating Plan (POP) submitted yearly by the OBPR as part of the NASA budget presented to Congress. The budget is based on:
  - Submits from the Program Offices representing payload development
  - Submits by the ISS Research Mission Management represented in functions 13, 14 along with Physical Integration @ KSC and Integrated Payload Operations @ MSFC
  - Submits for OBPR User Community research budgets are separate from the Utilization Budget, but are submitted by the respective Program Offices (e.g., Fundamental Space Biology, Biological Research and Countermeasures, Microgravity Research)
  - Current total budget for ISS Utilization (exclusive of Research) within OBPR is as follows*:

Fiscal Year	FY03	FY04	FY05	FY06	FY07
$M	340.7	336.1	325.8	289.0	282.8

* Data as of Aug 6

Baseline ISS Utilization Management Organization
Personnel and Staffing

- The workforce under the Baseline-Continuous Improvement Model includes both civil servants and support contractors and represents Code U Enterprise.
- Personnel numbers decrease over the 4 years due to activities and experience. It is assumed with Continuous Improvement, these numbers may decrease even more in the FY06 timeframe and beyond. Workforce, as reflected in the FY03 POP submits, are as follows:

	FY03	FY04	FY05	FY06	FY07
Civil Servants	626	608	589	569	557
Contractors	1780	1764	1634	1532	1467
Total	2406	2372	2223	2101	2024

- Personnel distribution for this workforce allocated to the 21 functions are shown in Figure G.

Baseline ISS Utilization Management Organization
Workforce Distribution Across the 21 Functions (Figure G)

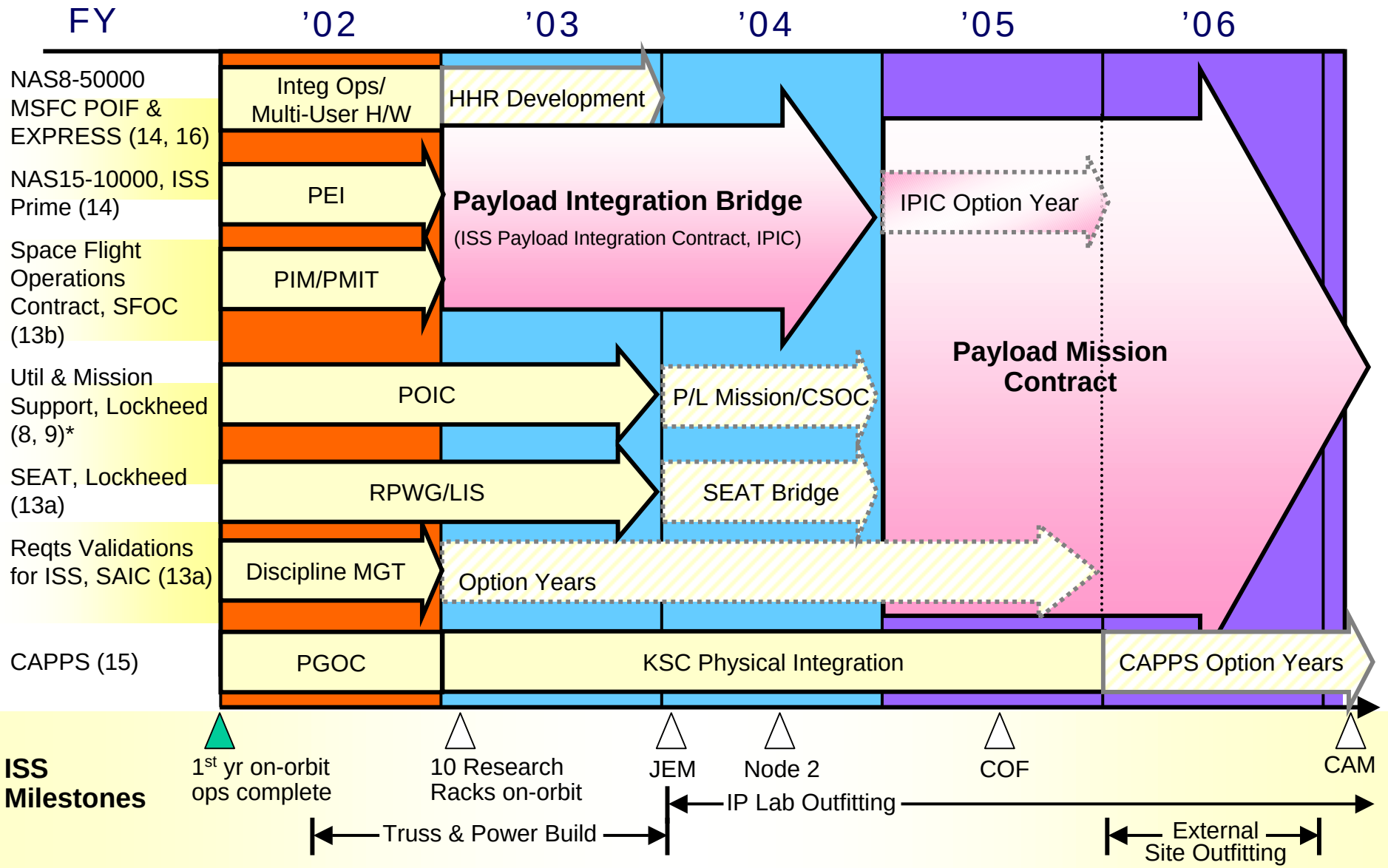
Functions	FY 03 Total		FY 04 Total		FY 05 Total		FY 06 Total		FY 07 Total	
	CS FTE	Cont WY	CS FTE	Cont WY	CS FTE	Cont WY	CS FTE	Cont WY	CS FTE	Cont WY
0 **Defining and Implementing Policy and Strategic Plans**	6	0	7	0	7	0	7	0	7	0
1 **Management of Research Utilization**	17	25	17	25	17	25	17	25	17	25
a Implement Strategic Plans										
b Manage Research Programs										
c Manage Integrated Research Utilization										
2 **Preparing and Allocating Budgets**	18	7	19	7	19	7	19	7	19	7
a Budget Formulation, Justifications										
b Budget Execution										
3 **Selecting and Prioritizing Research**	3	0	3	0	3	0	3	0	3	0
a Managing selection process										
b Selection										
c Prioritizing selections										
4 **Establishing Payload/Experiment Req & Feasibility**	26	71	24	68	23	67	22	66	17	66
a Research Requirements										
b Engineering Concepts, Development, & Hardware Assessments										
5 **Developing Cost, Schedule, and Risk Assessments**	26	17	26	17	28	17	30	18	31	20
a Perform Cost, Schedule, Risk Management Assessment										
b Authority to Proceed										
6 **Developing and Qualifying Flight Research Systems**	127	510	117	427	101	291	83	206	71	184
a DDT&E										
b Subrack Integration										
c Operations										
7 **Maintaining and Sustaining Flight Research Systems**	25	107	25	142	31	148	33	161	32	157
a DDT&E										
b Operations										
8 **Developing Ground Systems**	19	35	22	42	19	42	20	35	20	31
9 **Maintaining & Sustaining Ground Systems**	70	192	55	188	49	176	42	170	42	169
a Identify changes/upgrades to Research Flight Systems										
b Maintain & Sustain Research Ground Systems										
10 **Constructing Ground Facilities**	1	7	1	7	1	11	1	9	1	7
11 **Maintaining Ground Facilities**	5	36	6	40	6	37	6	36	6	37
12 **Certifying Safety of Research Flight & Ground Systems**	16	30	17	32	17	34	17	32	17	31
13 **Managing Missions and Allocating Services**	33	83	33	79	30	79	28	79	29	77
a Advocacy, Manifesting & Resource Allocations										
b ISS Research Mission Management										
14 **Integrating User Missions - Analytical**	46	238	46	247	46	240	46	226	46	192
a Payload Engineering Integration										
b Payload Software Integration & Flight Production										
15 **Integrating User Missions - Physical**	76	120	83	134	87	144	91	135	88	132
16 **Integrating User Missions - Operational**	72	254	63	256	57	260	49	265	52	269
a Payload Training										
b Operations Integration										
17 **Conducting Research & Analysis & Disseminating Results**	20	11	24	11	27	11	31	16	31	17
18 **Educating & Reaching Out to the Public (including industry)**	11	15	12	17	12	17	12	18	14	18
a Management & Control										
b Disseminate, Communicate & Support results to ISS customers										
19 **Recommending ISS Pre-Planned Product Improvements**	2	4	2	4	2	4	2	5	2	5
20 **Managing Archival of Research Samples, Data, and Results**	5	19	5	21	7	22	8	24	9	24
TOTAL	626	1780	608	1764	589	1634	569	1532	557	1467
Total Workforce	2405		2372		2223		2100		2023	

Baseline ISS Utilization Management Organization
Contract Transitions

- Most contracts supporting ISS are ending; ISS is consolidating functions supported by these contracts including the ISS Payloads Office (see Figure H)
  - ISS Payloads Office is consolidating Boeing contract support into one ISS Payload Integration Contract (IPIC) in FY 03
    - Immediate cost savings are expected with the reduction of management overhead and technical duplication
  - IPIC and the remaining functions will be consolidated in an open competition into the Payload Mission Contract in the FY 05 – 06 time frame
    - Depending on the readiness of the NGO, functions will transition from the Payload Mission to the NGO
    - ISS Payloads Office contract strategy protects for the possibility of no NGO
- Microgravity Research Program Office (MRPO) contractor task implementation and management consolidation is expected to reduce costs. (see Figure I)
  - Savings since consolidation began $150K with additional savings estimated $255K
  - Additional savings are expected due to lower civil servant contract management requirement

Baseline ISS Utilization Management Organization

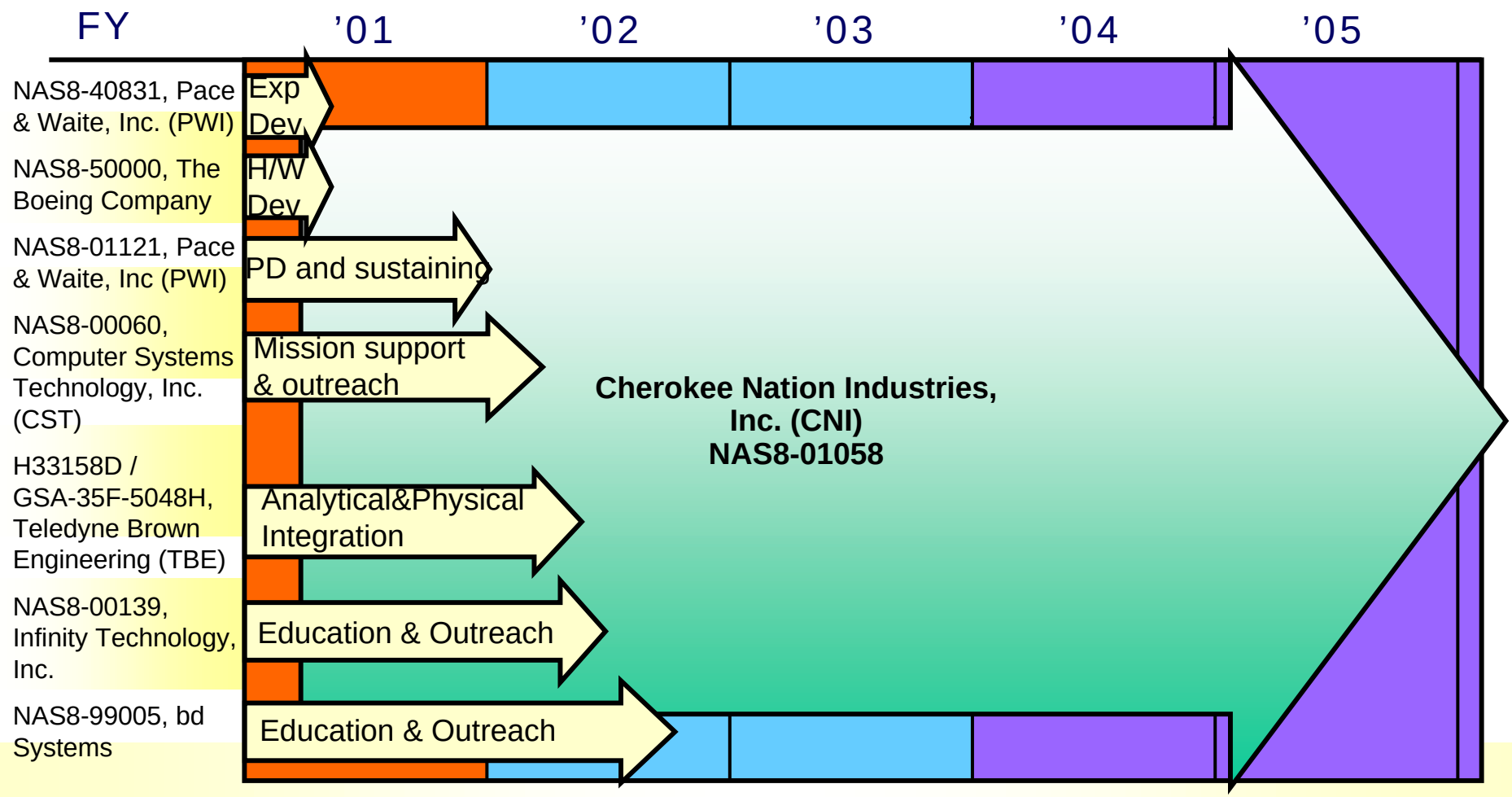
ISS Payloads Office Contract Strategy (Figure H)



* ISS Ground Segment only

Baseline ISS Utilization Management Organization

MRPO Contract Strategy (Figure I)



Baseline ISS Utilization Management Organization
Rationale

Rationale for Continuing Current Baseline

- Early Program focus on hardware development and on-orbit assembly
  - Early 2001 Program began operational phase supporting research on-orbit
  - Focus on improvement initiatives began in March 2001 and impacts are only recently being realized
- Interruption of current activities could result in:
  - Loss of corporate knowledge of as-built hardware
  - Disruption in improving relations with customer/researcher community
  - Risk to established vehicle and crew interfaces
- Direct interface between NASA and International Partners has proven effective

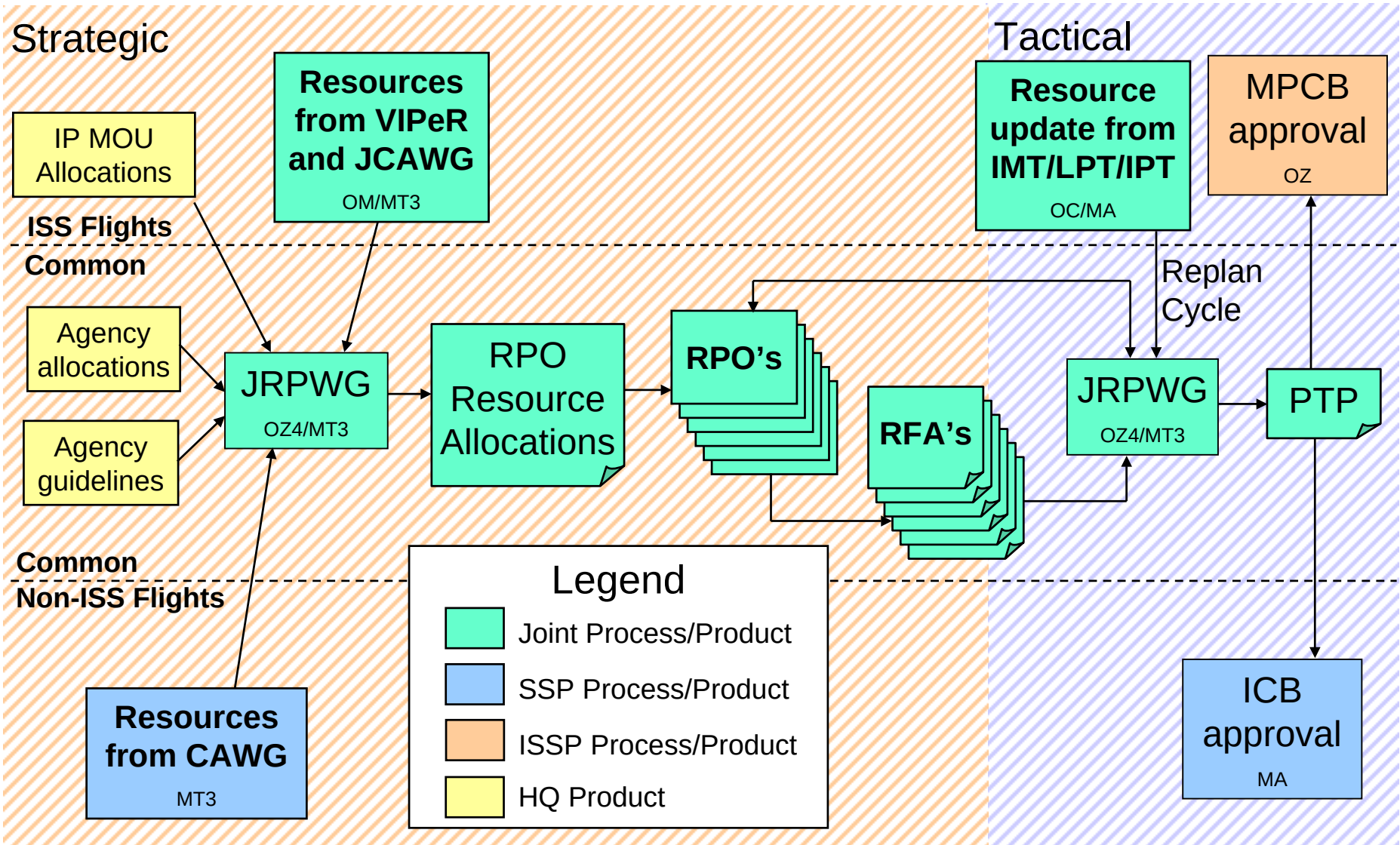
Baseline ISS Utilization Management Organization
Rationale (cont'd)

- To address the issues of inefficient processes and daunting organization structure the ISS Payloads Office and the Research Program Offices are taking steps to increase customer support including:
  - Incorporating incentives in consolidated Boeing contract to provide and increase customer support (Award Fee is based on customer satisfaction)
  - Expanding customer satisfaction efforts by providing a "hot-line" and a post-flight survey to measure satisfaction
  - Updating operations integration processes to support PDs through the process (e.g., procedure and display development, training)
  - Streamlining the requirements and re-enforcing the use of the documented processes

Baseline ISS Utilization Management Organization
Continuous Improvements

- Recent Continuous Improvements include both organizational and contract changes:
  - Transferred budget control to Office of Biological and Physical Research (OBPR) at NASA Headquarters
  - Strengthen science focus with appointment of ISS OBPR Program Scientist
  - Increased involvement of OBPR in decision making by participation in decision making Boards
  - Consolidated contracts supporting OZ activities and MSFC Research Program Office
  - Implemented initiatives at the Development Centers to reduce User verification requirements
  - Incorporated process improvements within the ISS Payloads Office and implementing Field Centers to improve User interfaces
  - Improved ISS resource commitments in upmass, middeck locker assignments and crew availability
  - ISS Payloads and STS Customer and Integration Offices implementing joint manifesting process to optimize research opportunities (Figure J)

Baseline ISS Utilization Management Organization
Combined Utilization Assignment Process (Figure J)



Model/Option Development Process

Overview of Option Development Process

Partitioning Criteria
- ISS Strategic Vision
- Guiding Principles
- Utilization Mgmt Objectives

Functional Models
A. NASA
B. S/T/C 'leadership'
C. B + sustaining payloads
D. C + developing payloads
E. D + msn mgmt/integrated ops
F. E + engineering
G. B + msn mgmt/integrated ops
H. G + engineering

Business Models
1. Single, Full and Open Contract
2. Non-Profit Institute
3. Cooperative Agreement
4. Space Act Agreement
5. State Corporation
6. Federal Corporation
7. Cooperative Association
8. Government Sponsored Enterprise
9. NASA Division (baseline)
10. FFRDC

Options
A1, A2, A3…etc.
B1, B2, B3…etc
.
.
H1, H2, H3…etc.

Initial Partitioning of Functional Models

Options Down-Select

		A NASA	B S/T/C Lead	C + Sust. Plds	D + Dev. Plds	E + MM/Ops	F + Eng.	G B + MM/Ops	H G + Eng.
1	For-Profit Contract	A1	B1	C1	D1	E1	F1	G1	H1
2	Non-Profit Institute	A2	B2	C2	D2	E2	F2	G2	H2
3	Cooperative Agreement	A3	B3	C3	D3	E3	F3	G3	H3
4	Space Act Agreement	A4	B4	C4	D4	E4	F4	G4	H4
5	State Corporation	A5	B5	C5	D5	E5	F5	G5	H5
6	Government Corporation	A6	B6	C6	D6	E6	F6	G6	H6
7	Cooperative Association	A7	B7	C7	D7	E7	F7	G7	H7
8	Government Sponsored Enterprise	A8	B8	C8	D8	E8	F8	G8	H8
9	NASA Division (baseline)	A9	B9	C9	D9	E9	F9	G9	H9
10	FFRDC	A10	B10	C10	D10	E10	F10	G10	H10

Not applicable
3- Not a Binding Agreement
4- NASA doesn't fund Space Act Agreements
5- State/Federal conflict considerations
7- Not a Binding Agreement
8- Privately Owned
1- Perceived conflict of interest regarding profit motive with S/T/C Leadership role

Option Down-Select Process

80 Options

- Review of various industry analyses (i.e. Swales, etc.) to distill advantages/disadvantages of candidate Business models
  - Applied advantages/disadvantages against Functional models for high-level feasibility assessment

29 Options

- Refined application of Business model advantages/disadvantages against Functional models

22 Options

- Conducted analysis of advantages/disadvantages for each variation to select an end-state Option for each Business model

4 Options

Functional Allocation Rationale

- Appropriate functional groupings were identified by the Blue Team for use in consideration of transferring functions to an alternative organization
- Once functional groupings were established, each Option Sub-Team used experience and best fit to determine functions designated to a specific business model
- Team consensus was to provide a broad range of options (with associated data) without a predetermination of the outcome
  - This broad range of options are considered representative paths with representative outcomes that allow Agency senior management to make informed decisions
  - Options presented are single-point solutions only. Variations and hybrids based on functional allocation and business model selection are viable solutions and should be considered

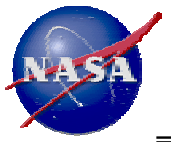
Selected Business Models

- **Institute** - An organization devoted to research, the development and transfer of technology, the provision of service to the scientific community and the public, and the facilitation of scientific and industrial community access to the International Space Station (ISS). Institutes are established under NASA Procedures and Guidelines (NPG) 5000.1, “Establishing a Science And Research Institute”.

- **Federally Funded Research and Development Center** - An organization that assists the United States government with scientific research and analysis, systems development, and systems acquisition, and brings together the expertise and outlook of government, industry, and academia to solve complex technical problems that cannot be solved by any one group alone. Centers are organized as independent, not-for-profit entities, with limitations and restrictions on their activities. This special standing permits a degree of access (e.g., the ability to partner with the NASA centers) and a long-term perspective not shared by commercial contractors.

- **Federal Government Corporation** – An organization that combines the flexibility of a business with the public purpose and public duties of a traditional governmental organization, maximizing efficiencies arising from commercial market forces, flexibility with regard to encumbering regulations, and the ability to access financial alternatives. The authority to charter a Federal Government Corporation derives from the Necessary and Proper Clause of the U.S. Constitution (chartered by a Federal Charter or chartered under incorporation laws of the District of Columbia).

- **Reinvention** - A new NASA Enterprise which builds upon the current organization and management structure to focus all ISS Utilization mission implementation activities within one centralized organization, facilitating greater responsiveness to the research community.



Option Presentations

Option Presentations

- General Assumptions and Considerations
- Institute
- FFRDC
- Government Corporation
- NASA Reinvention

General Assumptions and Considerations

- Science, Technology and Commercial utilization and their diverse community of users are the primary focus of ISS
- The primary goal of any alternative option is to maximize ISS utilization
  - Achieving maximization may include reasonable increased costs
- A limited number of diverse options are sufficient to characterize the range of approaches the Agency might pursue in implementing an NGO:
  - Ability to meet Agency objectives
  - Ease of implementation
  - Impact to budget, workforce and competencies
  - Advantages and disadvantages
- Budget and workforce estimates are considered sufficient for the purpose of model development and cross-comparison of the options. Additional detail will be required for implementation of any option or variation of the options

General Assumptions and Considerations, cont'd

- The application of current NASA interpretation of OFPP Policy Letter 92-1 is adequate to identify inherently/appropriately governmental (NASA) functions within ISS Utilization

  Initial assessment of ISS Utilization **inherently governmental** functions:

  All - Function 0, Define, Develop and Implement Policy and Strategic Plans

  Portions - Function 2, Preparing and Allocating Budgets

  2.1 Budget Formulation (except 2.1.1.5)

  2.2 Budget Justification

  2.3 Budget Execution (except 2.3.4.4)

  Portions - Function 5, Developing Cost, Schedule, and Risk Assessments

  5.5 Authority to Proceed

  Portions - Function 12, Certifying Safety of Research Flight and Ground Systems

  12.2.2.2 Issue Certificate of Flight Readiness Statement

  Initial assessment of ISS Utilization **appropriately NASA led** functions:

  All - Function 12, Certifying Safety of Research Flight and Ground Systems

  All - Function 15, Integrating User Missions - Physical

Initial assessments have been coordinated with the staff of the Competitive Sourcing Review Board

General Assumptions and Considerations, cont'd

- Competency impacts will need to be assessed from a Center and Agency perspective. Potential competency impacts by Center have been characterized as high, medium, or low for discussion purposes
- A generalization of facility impacts (high, medium, low) is sufficient to characterize the implications of each option
- Implementation planning for selected options will need to consider existing contract periods of performance and the need to bridge or modify existing contracts. Costs associated with any contract actions have not been identified
- Options will also need to be analyzed in light of Human Capital Impacts, Change Management Complexity and Transition Implications

General Assumptions and Considerations, cont'd

- Budget and Workforce data:
  - based on the OBPR POP-02 ISSRC Lead Center Recommend budget submission, partitioned at the 21 function level
  - reflects the Code U Enterprise only
  - are rough order of magnitude estimates and are for comparison across Options only
  - are not adjusted for full cost accounting
    - for estimating purposes, $150K per FTE is assumed for additional/new workforce and civil service work transitioned to new organization
  - Assumes no efficiencies beyond those included in POP-02
- Workforce for existing functions is transferred on a one-for-one basis with no assumptions of efficiencies gained
- For estimating and comparison purposes, NGO infrastructure costs are estimated at 20% of total organization workforce

Context

Backup Material

ISS Utilization Function Definitions

Function 0. **Defining and Implementing Policy and Strategic Plans.** This function includes the definition, development and implementation of public policies and strategic plans related to ISS research and utilization. Specific functions include organization and execution of boards, panels, working groups and advisory committees involved in the definition of research plans and processes; definition, development and coordination of national and international cooperation; and the organization of forums for planning development of research programs on a strategic global scale within public policy. Policy and plan implementation is distributed across both headquarters and field center organizations.

Function 1. **Management of Research Utilization.** This function represents the management of research utilization on the ISS. It includes strategic and tactical implementation of management functions.

Function 2. **Preparing and Allocating Budgets.** This function includes long-range and fiscal budget formulation, justification and budget execution of ISS research and utilization. Specific functions include budget preparation, legislative consideration and approval, budget execution oversight and reporting, and evaluation of performance

ISS Utilization Function Definitions - cont'd

Function 3. **Selecting and Prioritizing Research.** This function includes the announcement of research opportunities; operation of non-advocate peer panels in science and corresponding review bodies for technological or commercial projects; programmatic or other evaluations associated with the selection process; and selection / prioritization of experiments, tests, demonstrations, or other research activities on the ISS. This function includes both the investigations and the associated payload manifests to the ISS at the corresponding levels of detail associated with headquarters and field center prioritization and queuing processes. The prioritization function includes determination of national and agency priorities for utilization of the ISS, inclusive of commercial initiatives.

Function 4. **Establishing Payload/Experiment Requirements and Feasibility.** This function defines and documents the payload/experiment requirements necessary to fully accomplish a specific set of research objectives and/or goals. These requirements must be written in sufficient detail to determine the feasibility of successfully completing that investigation with: 1) existing flight experiment hardware, 2) some modification of existing flight experiment hardware, or 3) new flight experiment hardware concepts. In limited cases, these requirements are written to establish the feasibility of providing the capabilities necessary to accomplish a particular range and/or class of experiments through the use of a core facility and experiment unique payloads. When these requirements have been verified as sufficient, they are documented and entered into a program/project configuration management system. This definition covers the Formulation Phase of a project.

ISS Utilization Function Definitions - cont'd

Function 5. **Developing Cost, Schedule and Risk Assessments.** This function includes the development of estimates of the costs for Ground and/or Flight Systems needed to satisfy ISS research requirements as well as estimates of when theses systems will be available for deployment and operations. These cost and schedule assessments can involve estimates for accomplishing the research objectives through the use of existing systems, the modification of existing systems, or the development of new systems. NASA will use these estimates during ISS research planning and during the process of approving new system developments. The fidelity of the cost and schedule estimates will be characterized through an assessment of the risks involved in providing the needed systems within the cost estimate and by the estimated deployment date. NASA's need for high fidelity cost and schedule estimates may require risk reduction through technology development/demonstration efforts as a part of the function. This may include work necessary for NASA to estimate pricing and evaluate commercial proposals. This definition covers the Approval Phase of a project.

Function 6. **Developing and Qualifying Flight Research Systems.** This function represents the design, development, test, integration and evaluation of flight research equipment (i.e. hardware and software) used in the transportation, accommodation or operation of research payloads on the ISS, including the preparation of all necessary documentation, configuration control and conduct of qualification and acceptance/certification testing and acceptance procedures, protocols and processes to ensure that all requirement are met. Flight research equipment refers to subrack payloads, facilities, multi-use equipment, etc. For facilities, the activities described below will often include an integrated effort where the facility developer must include and assess inputs from individual subrack payloads to form a part of their facility effort.

ISS Utilization Function Definitions - cont'd

Function 7. **Maintaining and Sustaining Flight Research Systems.** This function represents the maintenance, operations and sustaining engineering of flight research systems (e.g. facility payloads, EXPRESS Racks, EXPRESS Pallet) through upgrades, replacement, or spares. It represents the recurring costs associated with Function 6.

Function 8. **Developing Ground Systems.** This function represents development of all multi-user, discipline-specific and experiment-unique ground systems necessary to support the successful operation of the flight research systems. It includes all associated systems, subsystems, components or other related items (e.g. communications, data processing, data analysis equipment, GSE, training hardware and simulators) necessary to the ground program. This function excludes the development of ground systems that also serve non-ISS programs and projects. This function represents those major systems that have a non-recurrent cost.

Function 9. **Maintaining and Sustaining Ground Systems.** This function represents the maintenance, operations, and sustaining engineering of multi-user, discipline-specific and experiment-unique ground systems or equipment (e.g. communications, data processing, data analysis equipment, GSE, training hardware and simulators). It represents the recurring costs associated with Function 8. This function excludes maintaining and sustaining ground systems that also serve non-ISS programs and projects.

ISS Utilization Function Definitions - cont'd

Function 10. Constructing Ground Facilities. This function represents major acquisitions in terms of buildings, laboratories and test facilities, including initial outfitting of capital equipment (e.g. overhead cranes, lab benches, autoclaves, hoods) and furniture, associated with multi-user and discipline-specific ISS research and utilization. This function may include construction of ISS-specific portions of facilities that also serve non-ISS programs and projects and represents major acquisitions that have a non-recurrent cost.

Function 11. Maintaining Ground Facilities. This function represents the maintenance, operations, and sustaining engineering associated with buildings, laboratories, and test facilities for multi-user and discipline-specific ISS research and utilization (e.g. Control Centers, Telescience Centers). This function may include maintaining ISS-specific portions of facilities that also serve non-ISS programs and projects. It represents the recurring costs associated with Function 10.

Function 12. Certifying Safety of Research Flight and Ground Systems. This function represents the assessment of payload safety at the system, subsystem, component, and sample/specimen levels, including the safety of procedures, protocols and processes associated with payload, or experiment, transportation, accommodation or operations. This function includes safe design, manufacture, verification, and operation. It also includes preparation and presentation of safety data packages, including integrated safety data packages for a compliment of payloads or experiments. The responsibility for final approval of safety will remain with NASA.

ISS Utilization Function Definitions - cont'd

Function 13. Managing Missions and Allocating Services. This function includes the definition and commitment of services between the end-user, or payload developer, and the Agency in order to ensure timely production of all user hardware, software and documentation deliverables in accordance with pre-agreed milestones. This function also includes the planning, integrating, and scheduling and of all user-related activities necessary for successful multilateral utilization of the space station in flight or on the ground in pre and post-flight periods. User related activities include: (1) transportation assignments to launch vehicles; (2) physical accommodation assignments to the space station user accommodation elements, and; (3) operating period assignments on the space station with corresponding resource allocations for crew time, energy, data transmission and any unique resources specific to individual user activities. In order to plan, integrate and schedule these critical user activities efficiently and effectively on a multilateral basis, the mission management function is also responsible for directing the orderly performance and timely completion of all remaining principle functions which are on the critical path to user transportation, accommodation and operations. In cases where joint program commitments are required among the station partners in order to transport, accommodate, or operate user elements, this activity includes the negotiation of joint program documents and management of the implementation phase.

ISS Utilization Function Definitions - cont'd

Function 14. **Integrating User Missions - Analytical.** The purpose of analytical integration to ensure safe and functional hardware and software interfaces. The 'user' side of the interface may be an experiment, a payload, or a payload complement. The 'operator' side of the interface may be the crew, a rack, a pallet, an ISS laboratory module, an exposed facility, launch vehicle(s), ground operations center(s); any of which may belong to one or more International Partners. Functions necessary to ensure safe and functional interfaces include: negotiation of Interface Control Documents, development of interface verification plans, certification of interface verification procedures, analyses and/or testing to support interface verification, analyses and/or testing to support verification, safety and compatibility of a complement of payloads, development and certification of complement-unique software configurations, development of operational constraints, and real-time support for anomaly resolution.

Function 15. **Integrating User Missions - Physical.** This function includes the physical buildup, testing, validation/ verification of functional interfaces, specialized science processing, and integration of experiments, payloads, or payload complements during the ground processing phase in preparation for launch to the ISS. This function also includes physical deintegration of experiments and payloads at the landing site.

ISS Utilization Function Definitions - cont'd

Function 16. Integrating User Missions - Operational. This function includes the near real-time activity conducted at payload and station operations centers. This includes short term planning and replanning, contingency planning, and responses to unplanned events associated with or otherwise affecting the ISS research program at all levels. Payload training activities are also included in this function.

Function 17. Conducting Research & Analysis and Disseminating Results. This function represents the work of the principal investigator in scientific endeavors, or the project investigator in technological or commercial endeavors, that is directed toward the achievement of research objectives. The investigator specifically leads the development of requirements and objectives for the research, undergoes appropriate research review, is involved in the experiment procedure development and on-board real-time research operations, conducts analysis of the data and/or samples, prepares operational reports, compares results to objectives, submits research reports, provides input to the archiving process, and participates in research conferences to report and discuss results to the research community.

ISS Utilization Function Definitions - cont'd

Function 18. Educating and Reaching Out to the Public (including industry). This function includes the development, dissemination and evaluation of information to the public through a wide variety of methods in order to educate and broaden awareness of the ISS program and its associated benefits and to inspire the next generation of explorers.

Function 19. Recommending ISS Pre-Planned Product Improvements. This function represents the user community recommendations and priorities for improvement of ISS productivity through upgrades, changes, or additions to the ISS spacecraft systems, elements, and/or processes which enhance the quality or quantity of user accommodations or operations, this supports the broader P^3I objectives of the Program.

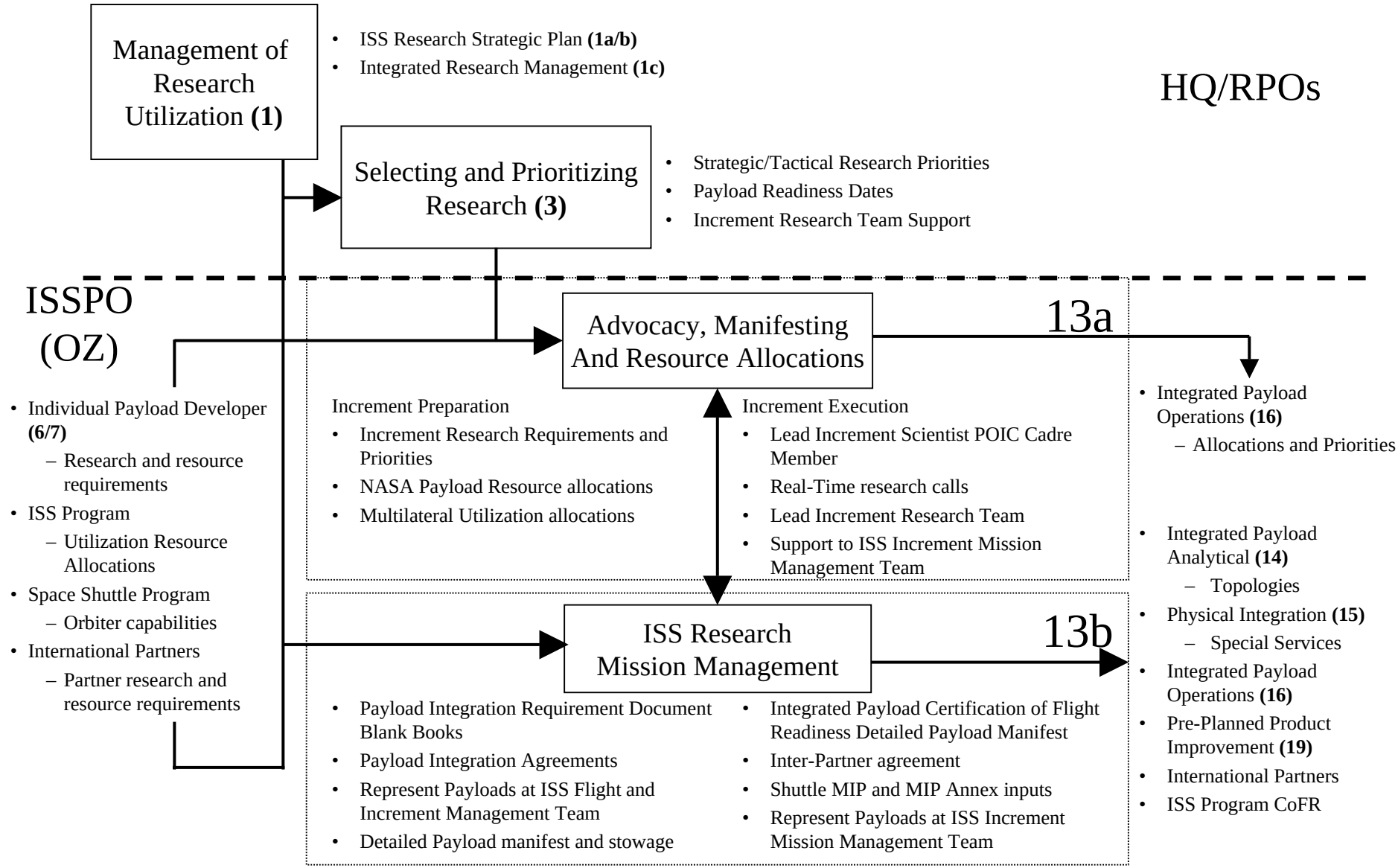
Function 20. Managing Archival of Research Samples, Data and Results. This function represents the management of ground archiving of research products in accordance with established processes for future use in an accessible manner that ensures preservation of information. The function also includes facilitating and enabling the distribution of results. Research samples, data and results that are proprietary in nature will continue to be maintained by the industrial sponsor.

Baseline ISS Utilization Management

Backup Material

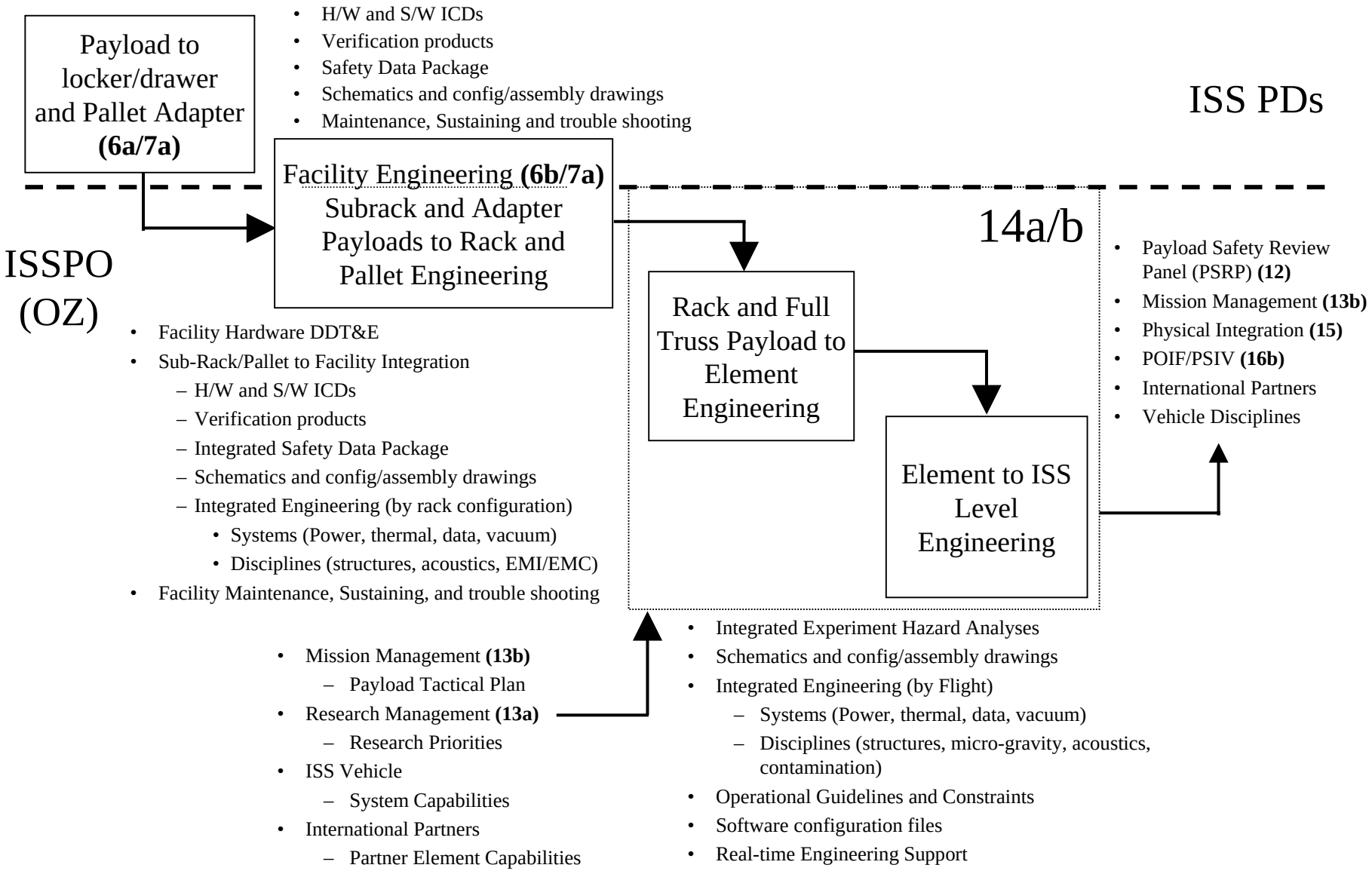
Baseline ISS Utilization Management Organization

Transaction Flow: Managing Missions and Allocating Services



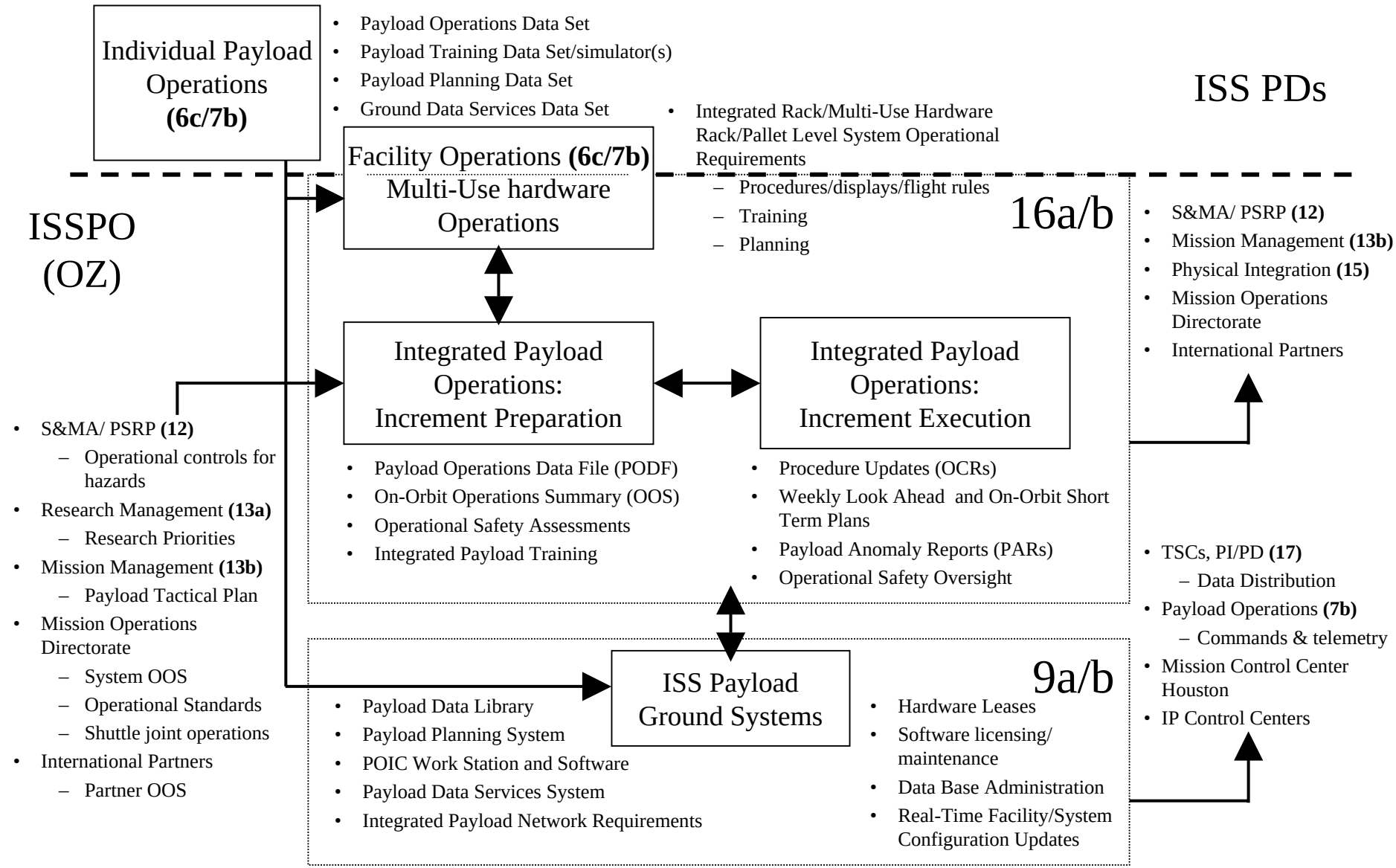
Baseline ISS Utilization Management Organization

Transaction Flow: Integrating User Missions - Analytical



Baseline ISS Utilization Management Organization

Transaction Flow: Integrating User Missions - Operational



Baseline ISS Utilization Management Organization
Considerations - Payload Safety

- All aspects of ISS Safety are appropriately governmental and will not be delegated to a non-NASA entity
  - Individual payload safety
  - Integrated rack/pallet/carrier safety
  - Integrated element/Station safety
  - Operational safety
  - Ground safety
- Activities performed by the ISS Payloads Office in support of the above tasks will be maintained within the ISS Program
  - Integrated Experiment Hazard Analyses (IEHA) {Function 14}
  - Payload operational hazard analyses and control (preflight and real-time) {Function 16}
  - Multi-Use Integrated rack/pallet/carrier safety {Function 6}
- Utilization Management Options that propose the performance of the above functions will have to address the safety considerations with the ISS Program

Baseline ISS Utilization Management Organization
Considerations - Certification of Flight Readiness

- In JSC's FAIR Briefing (May 2002), ISS provided rationale for the following as inherently governmental (managed/overseen by a critical mass of the government at NASA):
  - Certification of flight readiness for ISS hardware & software
  - Establishing Government policy and strategy for ISS development & operations
    - Federal Government's Assets and on-orbit policies for the Space Station
    - Flight hardware & software requirements integrated with International Partners (IP)
    - Flight manifest and assembly sequence integrated with the IPs
- Therefore, activities performed by the ISS Payloads Office in support of the above tasks will be maintained within the ISS Program (i.e., ISS Payloads Office performs ISS Vehicle Functions)
  - Interface and complement compatibility {Function 14}
  - Command and control database has been verified {Function 14 & 16}
  - Validation of Procedures and displays resident on ISS computers {Function 16}
  - POIF Cadre are certified to support ISS subsystem management {Function 16}
  - All safety related training activities have been performed {Function 16}
- Options that propose the performance of the above functions will have to address the above engineering considerations with the ISS Program

Baseline ISS Utilization Management Organization
Definitions

- Principal Investigator: Investigator responsible for the definition of the investigation and analysis associated with experiments selected to be implemented in the space environment. The PI may also be the PD
- Payload Developer: Represents and is responsible for a single or a combination of same discipline experiments from project initiation through completion of data analysis
- Research Program Office (RPO): Organization responsible for defining research objectives and priorities for it's assigned discipline, as well as experiment implementation and recommended assignment to a given carrier

Model/Option Development Process

Backup Material

Model/Option Development Process
Functional Definitions

- Functions were identified having primary characteristics which could be used in differentiating models of an NGO. The primary characteristics included:
  - Science/Technology/Commercial (S/T/C) Leadership
  - Sustaining Payloads
  - Developing Payloads
  - Mission Management and Operations
  - Engineering
- Characteristics were subsequently additive to reflect increasing levels of responsibility, e.g., Leadership + Sustaining Payloads (C).

NOTE: Those elements reflecting an inherently government function (policy and strategic plans – [Function 0]), the user (conduct of research and analysis [Function 17]), and Safety [Function 12] are not within the purview of an NGO.

Model/Option Development Process
Functional Definitions, cont'd

Science/Technology/Commercial Leadership

Leadership reflects a level of responsibility and accountability, which the User and other External entities recognize as *managing* and as *providing leadership* in ISS Utilization Management (e.g. RPWG) including:

- Implementing strategic plans and managing research programs (1.1, 1.2)
- Formulating and implementing budgets along with costs, schedule, and risk (2.0, 5.0)
- Advocating, selecting, and prioritizing research (3.0)
- Manifesting and resource allocations (13.1, 13.2, partial 13.3)
- Outreaching to public and industry (18.0)
- Recommending and implementing ISS process improvements (19.0)
- Managing archival of data (engineering, environmental, samples not held by the experimenter) (20)

Leadership must be provided objectively in order to avoid the appearance of conflict of interest.

Model/Option Development Process
Functional Definitions, cont'd

Sustaining Payloads

Sustaining Payloads involves maintenance and refurbishment of the flight experiment support hardware and software and associated ground systems developed for research aboard ISS. This includes the racks and pallets where the hardware/facility is located. This is a recurring function and will require a level of engineering competence. (7.0, 9.0)

Model/Option Development Process
Functional Definitions, cont'd

Developing Payloads

Developing payloads (6.0) involves design, development, test, integration, and evaluation of the S/T/C facilities, payloads and ground systems (8.0) to conduct research. It also includes the development of S/T/C experiment requirements and feasibility (4.0) and resultant experiment unique hardware and supporting ground tests to conduct experiments on ISS. Recurring elements include:

- Sub-rack integration of experiment unique elements, performing accompanying engineering analysis, and providing their resultant products (6.0, 7.0)
- Operations elements as training, simulations, timeline, flight real-time support for logistics, anomaly resolution, data capturing
- Logistics including sparing inventory, bonded stores, shipping/receiving to/from launch/landing site

Model/Option Development Process
Functional Definitions, cont'd

Mission Management/Integrated Operations

Mission Management implements the requirements and priorities established by the S/T/C Leadership function and provides integration of all execution-level elements in each mission and includes:

- Detailed manifesting and allocating services by flight/increment (13.3, 14.1, 14.2)
- Integrating all S/T/C users
- Chairing Boards approving hardware and experiment elements
- Interfacing to ISS/STS/ETOV elements

Integrated Operations elements include: (14.3, 16.0)

- Planning
- Training
- Integrating crew procedures, experiment displays, etc.
- Retrieving flight data for S/T/C elements and ancillary data
- Real-time flight operation

Model/Option Development Process
Functional Definitions, cont'd

Engineering

Engineering is the integration (both analytical and physical) of all data, software, and hardware products submitted as part of an ISS mission. It includes both internal and external elements. Typical tasks include: design and development of hardware and software, verification of hardware (mechanical and electrical) and software through test and analyses, and integration of hardware and software into a whole system. Engineering tasks are further elaborated under definitions:

- 6.2-6.9
- 7.2-7.8
- 8.0-8.41
- 9.2.3
- 14.0
- 15.3
- 16.0